CLIMATE CHANGE ADAPTATION ADVISORY COMMITTEE

July 30, 2009

General Overview

Kathleen Baskin, EEA

General Overview

- **Information Sharing**
  - **Website:** http://www.mass.gov/dep/public/committee/ccaac.htm
    Subcommittee Pages - Contact Information and References
  - **Public Information Sessions: Schedule, Presentation**
- **Regional Coordination**
- **Common Themes**
- **Science and Data**
- **Individual Committee Reports**

Public Information Sessions

- **Eight sessions held throughout the Commonwealth**
  - **June 11: Worcester**
  - **June 24: Hyannis**
  - **June 30: Wilmington**
  - **July 01: Springfield**
  - **July 02: Lakeville**
  - **July 15: Boston - Downtown**
  - **July 16: Boston – Roxbury**
  - **July 16: Pittsfield**

- **Public invitation extended through**
  - **CCAAC Website**
  - **Environmental Monitor**
  - **E-mail Distribution**

Common Questions Asked

- **Long Term Planning**
  - **How will Committee's Report be used?**
- **Communication**
  - **Educating the public**
  - **Developing a consistent message**
- **Mitigation versus Adaptation**
  - **Mitigation as an adaptation strategy**

Regional Coordination

- **NESCAUM (Northeast States for Coordinated Air Use Management)**
  - **Phone call between 6 NE states, NJ, NY**
  - **Management of common data needs – federal agencies and states**
  - **Pilot programs/studies**

- **EPA**
  - **Information sharing**

Common Themes
(@ Sub-Committee Meetings)

- **Understanding the past may no longer be relied upon as the basis for planning for the future**
  - **Impacts on Wetlands**
  - **Floodplains**
  - **Insurance**
  - **Mortgage banking**
- **Mitigation - to close uncertainty gap and reduce vulnerability**
- **Data and Modeling**

Science & Data

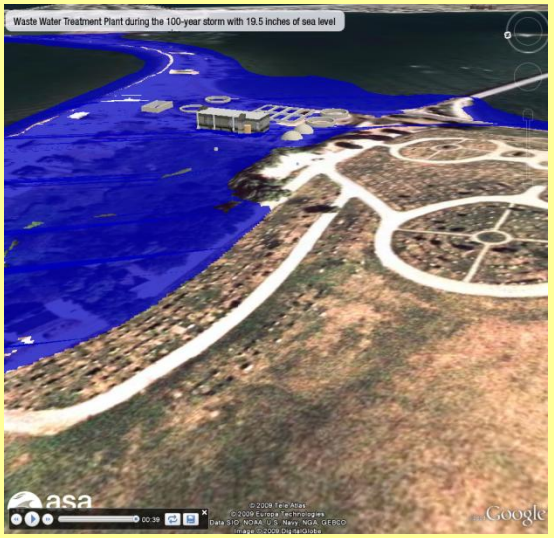
- **Monitoring, historic datasets, scientific theories, climate models, experiments are key strategic resources for Climate Change adaptation**
  - **leverage existing activities**
  - **correlation is not causation**
  - **value of long-term data collection**
  - **expect the unexpected**

- **Too much science?**

- **How can climate change stakeholders help set the research agenda?**
  - **mechanisms for input into Federal/academic dialog**

Going Forward

- **Major Data Gaps**
  - **Elevation data - LiDAR**
    - **SLR, extreme precipitation events**
  - **Floodplain mapping – iteration**
    - **history is no guide to the future**
  - **Inventories/surveys of facilities**

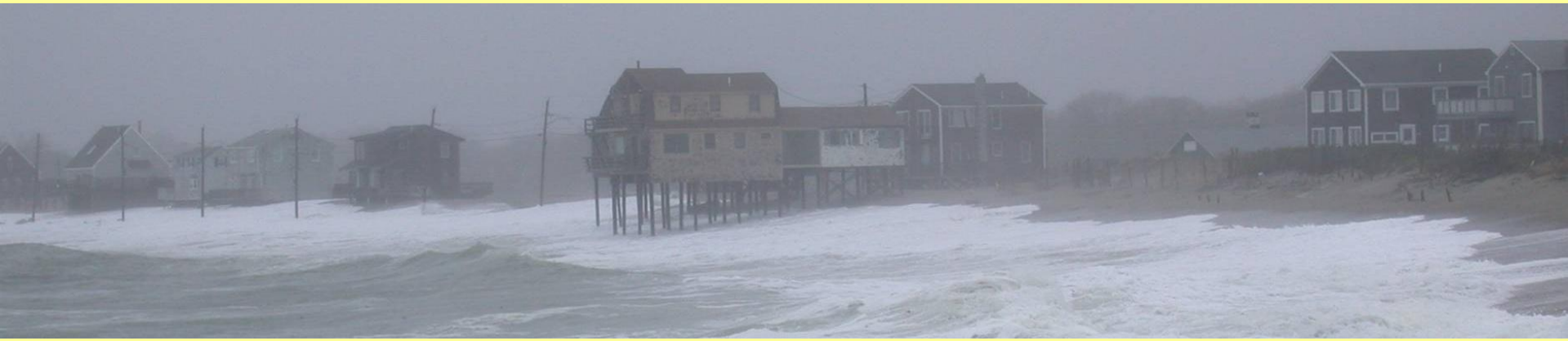


- **Beyond sectors – common issues**
  - **What predictions do we trust?**
  - **How do we quantify risks and evaluate strategies?**
  - **How do we coordinate data collection?**
  - **How do we translate science into policy/regulation?**

REPORTS from SUB-COMMITTEES

Summary Discussion

Coastal Zone and Ocean

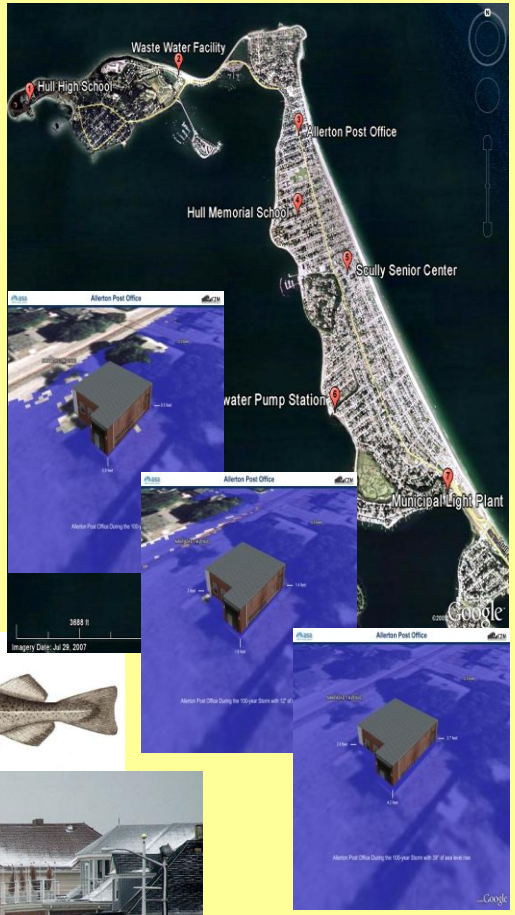


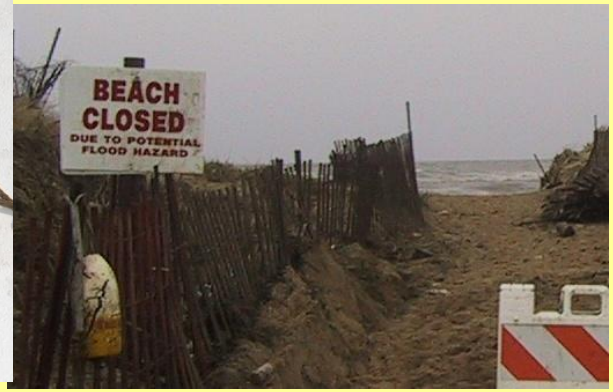
Wayne Klockner, The Nature Conservancy

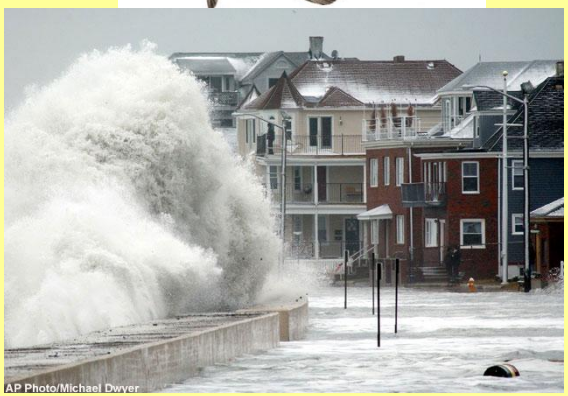
Key Sectors Reviewed

Coastal Zone and Ocean

- Coastal habitats/resources/services
- Ocean habitats/resources/services
- Public structures and critical facilities
- Residential and commercial development
- Ports and harbors
- Public access, recreation, and tourism







Examples of Potential Vulnerabilities

Coastal Zone and Ocean

- **Sea-level rise and flooding**
  - **Loss of beach and estuarine habitat due to drowning and migration barriers**
  - **Degradation of freshwater drinking supplies through saltwater intrusion into aquifers**
  - **Damage to public and private development, infrastructure, critical facilities and port assets**

- **Physical ocean conditions (temp, pH, salinity, currents)**
  - **Decreased primary and secondary productivity with cascading trophic effects**
  - **Shifts in location of suitable coastal and marine habitats**
  - **Loss of commercial fishing and aquaculture revenue due to stress, diseases and pathogens**

Examples of Potential Vulnerabilities

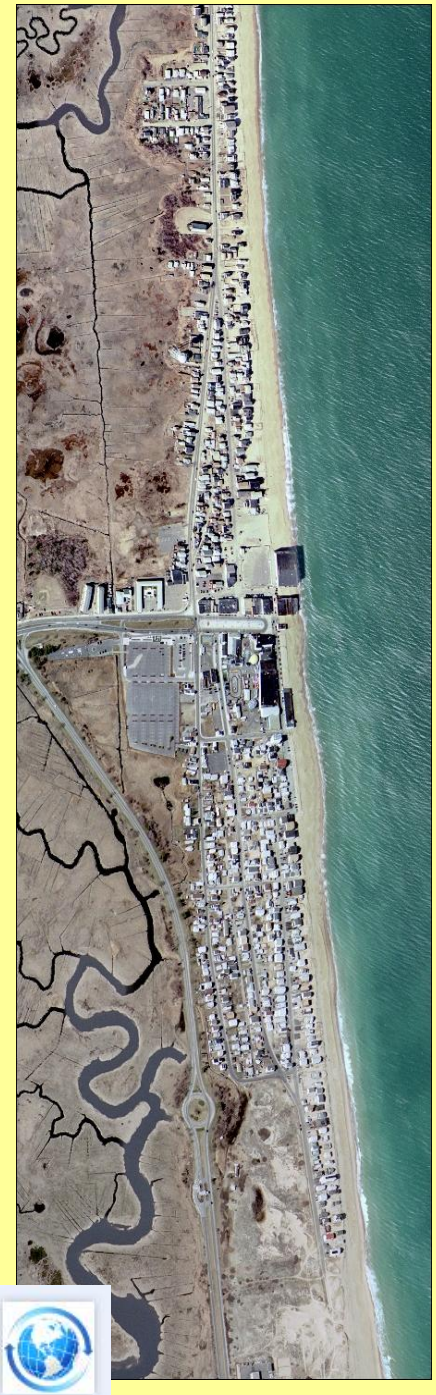
Coastal Zone and Ocean

- **Precipitation**
  - **Increased polluted runoff and combined sewer overflow events with negative effects on estuarine and marine water quality, resources, human health, and economies**
- **Extreme weather events**
  - **Loss of life due to high-risk development in vulnerable floodplains and along shorelines**
  - **Increased damage to development, infrastructure, critical facilities and port assets**
- **Other**
  - **Decreased public access, recreational opportunities and tourism revenue due to beach erosion and loss of waterfront**
  - **Increased harmful algal blooms and human health effects**

Examples of Possible Strategies

Coastal Zone and Ocean

- **Coastal and marine habitats/resources/services**
  - Increase habitat restoration scope and capabilities
  - Conservation of valuable ecological resources to provide zones for migration
  - Delineating resources to account for future migration
- **Public structures and critical facilities**
  - Design and site new structures and facilities according to sea-level rise projections
  - Relocate structures and facilities esp. when significant repairs or replacement required
- **Residential and commercial development**
  - Raise existing development and utilities above the base flood elevation
  - Acquire high-risk properties from willing sellers in fee or through conservation restrictions and easements to minimize loss
  - Land-bank development areas for property relocations and TDRs
- **Ports and harbors**
  - Develop new technologies to track conditions and failure of systems
  - Site key operations and hazardous material storage above the base flood elevation
- **Public access and tourism**
  - Strengthen public access requirement for placement of public sediment on private beaches
  - Improve estuarine and marine water quality through LID, and stormwater and wastewater systems



Common Themes

Coastal Zone and Ocean

- Vulnerabilities primarily due to increases in sea level and temperatures
- Key science and technology advancements will enhance risk and vulnerability assessments
- Ecosystem services must be included in comprehensive planning
- Insurance incentives will increase implementation of adaptation measures
- Cities and towns need technical and financial support (grants, loans and investments)
- Adaptation options for the marine environment are more limited

stormsmart coasts
supporting community efforts to manage coastal floodplains
mass.gov/czm/stormsmart

Questions?

Coastal Zone and Ocean

Thank You

Human Health and Welfare

Paul Epstein, Harvard Medical School

Key Sectors Reviewed

Human Health and Welfare

- **Public Health**
- **Agriculture and Food Systems**
- **Air Quality**
- **Water Quality**
- **Vulnerable Populations**
- **Cultural Resources**

Examples of Potential Vulnerabilities

Human Health and Welfare

- **Sea Level Rise and Flooding**
  - **Displaced Persons: damaged shelter and migration impacts**
  - **Loss / change to coastal cultural resources**

- **Temperatures**
  - **Heat stress and air quality impacts**
  - **Changes in crops and new invasive species**
  - **Drought and decreased water quantity**

Examples of Potential Vulnerabilities

Human Health and Welfare

- **Precipitation**
  - Increase in mosquitoes, ticks, and associated diseases
  - Increasing indoor mold growth
  - Sanitation: drinking water and contamination

- **Extreme Weather Events**
  - Injuries and property damage (including effects from erosion, wind and water)
  - Food Security
  - Destruction of historical, archeological, and agricultural sites

- **Other**
  - Public communication
  - Vulnerable Populations: economic & geographic, decreased ability to recover/respond

Examples of Possible Strategies

Human Health and Welfare

- **Sector #1: Public Health**
  - **Increase public awareness of heat and air quality (heat stress, impacts on asthmatics), vector-borne diseases, and ensure health sector treatment capacity**
  - **Create and publicize public "Cool" spaces for heat waves**
- **Sector #2: Agriculture**
  - **Anticipate and plan for agricultural crop shifts, animal stress, irrigation needs**
  - **Diversify crops in typology and geography**
- **Sector #3: Air Quality**
  - **Prominently feature air quality and health advisories in local weather updates**
  - **Encourage healthy energy use (decrease air pollution from fossil fuels, increase renewables, foster walkable urban centers)**

Examples of Possible Strategies

Human Health and Welfare

- **Sector #4: Water Quality**
  - **Increase surveillance of and barriers for new sources of contamination**
  - **Create a network for ambient water quality data sharing**

- **Sector #5: Vulnerable Populations**
  - **Focus and develop proactive health programs for vulnerable: elderly and young**
  - **Prepare for "climate refugees" – shelter and other basic health needs**
  - **Establish warning systems for those without internet or TV and non-English speakers**

- **Sector #6: Cultural Resources**
  - **Secure irreplaceable archives in climate controlled environments**
  - **Prioritize coastal and floodplain archaeological sites for study**

Common Themes

Human Health and Welfare

- **Expand current capacity for protection and resilience**
- **Most healthy mitigation strategies are also healthy adaptation strategies!**
- **Public awareness is key to both preparedness and response**
- **Vulnerable populations should be a focus: those with**
  - **Health Pre-dispositions (asthma, cardio-vascular illness)**
  - **Limited resources**
  - **Geographic risk – proximity to coast or flood zones**
- **Emergency response: Local and state officials need access to information, vulnerability assessments, resources and support**
- **Agricultural response will be iterative: can be built from research on new crops, outreach on IPM and soil conservation, loans for livestock infrastructure changes**
- **Increased surveillance of health impacts, assessment of treatment capacity**

Questions?

Human Health and Welfare

Thank You

Key Infrastructure

Edward Kunce, MassDEP

Key Sectors Reviewed

Key Infrastructure

- Air and Sea Transport
- Built Infrastructure and Public Buildings
- Dam Safety and Flood Control
- Energy
- Public Safety
- Public Water Supply
- Roadway System
- Solid and Hazardous Waste
- Stormwater
- Telecommunications
- Wastewater

Subcommittee Process

Key Infrastructure

- **Sector Point Person**
- **Working Groups**
  - **Larger sectors (Energy and Water) meeting separately**
  - **Involvement of multiple stakeholders**
- **Meetings**
  - **Excellent participation, over 30 attendees per meeting**
  - **Involvement of multiple CCAAC members**
  - **Cross-involvement with all other subcommittees**
  - **Effective presentations and discussions on sector topics**

Examples of Potential Vulnerabilities

Key Infrastructure

- **Sea Level Rise and Flooding**
  - **As a state with extensive coastal and riverine areas, many infrastructural resources are at risk from flooding, storm surge, and salt water intrusion, including:**
    - **Logan Airport and marine terminals; Electrical, gas, and telecommunications infrastructure; Roads, tunnels, bridges, and dams (public safety risk); Water supply and wastewater management**

- **Temperatures**
  - **Increased summertime energy demand compounded by heat-stressed electrical equipment**
  - **Public water supply affected by reduced aquifer recharging, increased irrigation demand**
  - **Aircraft performance deteriorates, so longer runways required, affecting air traffic patterns**

Examples of Potential Vulnerabilities

Key Infrastructure

- **Precipitation**
  - **Increased hydraulic loads to wastewater and stormwater systems will cause more CSOs & SSOs**
  - **Localized flooding and electrical systems outages of airport facilities, roads, and tunnels**
  - **Decreased water supply in summer months**

- **Extreme Weather Events**
  - **High winds, hurricanes, storm surges, and waves can damage energy infrastructure, ports, and buildings**
  - **Gulf Coast events affect natural gas supply transmission**
  - **Reduced emergency response capacity and public safety hazards**

- **Other**
  - **Existing building practices, materials, and codes may not adequately address predicted impacts including flooding, ice storms, thermal stress, heat waves, and enhanced mold conditions**

Examples of Possible Strategies

Key Infrastructure

- **Opportunity to start making "directionally correct" changes**
  - **Funding assistance incentives/criteria**
  - **Design specifications and building codes**
  - **Permitting conditions, etc.**
- **With 100-year planning period, opportunity to change paradigm of how we meet infrastructure resource demands**
- **Call for stronger federal leadership**
  - **e.g., protecting coastal resources, changing insurance practices, flexibility in funding programs**
- **Reserve major changes and investments until more confidence about specific impacts**

Common Themes

Key Infrastructure

- **Regional approach could address many issues effectively**
- **Energy and transportation systems are critical elements of meeting infrastructure adaptation, emergency preparedness, and national security strategies**
- **Increase decentralization of infrastructure elements, increase their efficiency, and decrease their use to maximize adaptive and national security objectives**
- **“No regrets” strategies can be pursued in all sectors: leading by example can encourage behavioral change**
- **LiDAR and updated floodplain maps valuable for planning and implementing a cost-effective infrastructural adaptations**

Questions?

Key Infrastructure

Thank You

Local Economy and Government

Karen O'Reilly, Lexington Insurance Company

John Clarkeson, EEA

Key Sectors Reviewed

Local Economy and Government

- **Weather Dependent**
  - **Agriculture**
  - **Fishing**
  - **Tourism & Recreation**
- **Service Industries**
  - **Health Care**
  - **Higher Education**
- **Manufacturing**
- **Local Government**
  - **Emergency Preparedness**
  - **Public Works**
  - **Vulnerable Populations**

Examples of Potential Vulnerabilities

Local Economy and Government

- **Sea Level Rise and Flooding**
  - Affecting business and recreation dependent on water infrastructure, including salt water intrusion to fresh water supplies
  - Decisions regarding real estate use as well as infrastructure and transportation route will alter
  - Waterfront recreation attractions may be subject to erosion/alteration

- **Temperatures**
  - Lower winter heating costs but higher summer cooling costs
  - A repeating cycle of warming temperatures and increasing energy use could exacerbate mitigation efforts to reduce GHG
  - Extended seasons for tourism and agriculture, but will bring increased operational costs. Reliance on seasonal employment may shift from current to other labor pools
  - Increased need for irrigation, also impact on increased need for energy
  - Potential alterations in crops grown
  - Pressures on the population due to increase temperatures, especially in summer months: construction and other outdoor jobs; vulnerable populations; increased role for governments to assist with cooling shelters

Examples of Potential Vulnerabilities

Local Economy and Government

- **Precipitation**
  - **With other parts of the country experiencing severe drought, migration to Massachusetts of water dependent industries may occur**
  - **Increase in potential flooding**

- **Extreme Weather Events**
  - **Insurance risks/losses**
  - **Crop losses**
  - **Other business issues from interruptions of commerce, services**
  - **Emergency preparedness**

- **Other**
  - **Cultural features of Massachusetts may be altered**

Examples of Possible Strategies

Local Economy and Government

- **Local Economy: adaptation and mitigation strategies in other sectors may impact economic development**
  - **Development of new technologies to produce energy which have little or no greenhouse gas emissions**
  - **Protection and digitization of cultural assets, records to protect against damage from storm events**

- **Government: leadership role through research & long range planning**
  - **Revised building codes to increase resiliency to climate change as well as extreme weather impacts**
  - **Adjusting zoning to protect against alterations in the coastline and flooding hazards**
  - **Emergency Services**
    - **Decentralize Emergency Care Centers**
    - **Communication Networks: Review, test, and develop better and more effective communication, integrating local, regional and state entities**
  - **Improve science based flood plain assessment**
  - **Improved elevation data**

Common Themes

Local Economy and Government

- **Our desire for better information is great and that information should be sought rather than relying on speculation**
- **Planning needs to be future oriented. Simply basing on past performance will not suffice**
- **The desire for accurate elevation data, floodplain maps is immediate**

Questions?

Local Economy and Government

Thank You

Natural Resources and Habitat

Andy Finton, The Nature Conservancy

Key Sectors Reviewed

Natural Resources and Habitat

- **Natural Resources**
  - Forest Ecosystems
  - Coastal Ecosystems
  - Aquatic Ecosystems
  - Wetland Ecosystems
  - Intact Landscapes (e.g. watersheds and forest blocks)

- **Ecosystem Services and Functions**
  - Wildlife Habitat
  - Biodiversity
  - Carbon Sequestration
  - Water Purification/Quality
  - Water Storage/Supply/Aquifer Recharge
  - Flood Attenuation

Examples of Potential Vulnerabilities

Natural Resources and Habitat

- **Forest Ecosystems**
  - ↑ temperatures ⇒ species composition Δ, ↑ increase invasive plants, pests & pathogens
  - Altered water cycle and alterations of ⇒ Increased stress on native species.
  - ↑ temperatures ⇒ predator-prey relationships, phenology shifts ⇒ species composition Δ
- **Coastal Wetland Ecosystems**
  - SLR ⇒ ↓ & inundate intertidal habitats
  - Catastrophic storm events ⇒ alter coastal habitats
  - Increased precipitation ⇒ alter salinity regimes that maintain plant communities
- **Aquatic Ecosystems**
  - Altered hydrology & habitat fragmentation ⇒ alter community structure and dynamics, disrupt migratory patterns & life cycles
  - ↑ water temperature will ↑ vulnerability to invasive species and pathogens & ↑mortality
  - ↑ surface runoff and nutrient loading ⇒ ↓ quality and direct mortality of native species
- **Inland Wetland Ecosystems**
  - ↑ winter (rain)/spring precipitation, ↑ flooding, storm events ⇒ altered hydrologic processes
  - ↓ summer precipitation & drought ⇒ drying of wetlands
  - ↑ winter temperatures/↓ snowpack and ice ⇒ altered hydrologic processes
  - ↑ temperature ⇒ increase stresses on native wetland species ↑ non-native species
- **Intact Landscapes**
  - Increased temperature, storm events and precipitation ⇒ alterations in ecological processes, impact species distribution and community composition and ↓ ecological resilience

Examples of Possible Strategies

Natural Resources and Habitat

- **Forest Ecosystems**
  - Protect resilient forests based on representation, sufficient size, connectivity, and replication
  - Maintain vigor, protect regeneration
  - Reduce multiple stressors (e.g. restore and maintain connectivity, prevent invasions)
  - Enhance sequestration through planting
- **Coastal Wetland Ecosystems**
  - Remove existing impediments to tide line migration
  - Acquire and protect future wetlands sites
  - Establish better relationships between engineering and ecological solutions to sea level rise
  - Develop more ecologically sound planning and conservation regulations
- **Aquatic Ecosystems**
  - Restore and protect aquatic ecosystems and riparian buffer areas
  - Preserve and expand habitat connectivity/reduce fragmentation
  - Promote sustainable development and storm water management
  - Watershed planning policy and technical assistance
  - Improve modeling, mapping and data collection and encourage adaptive management

Examples of Possible Strategies

Natural Resources and Habitat

- **Inland Wetland Ecosystems**
  - Protect and restore floodplains and discourage floodplain development
  - Increase protection of vegetated buffers around wetlands, waterways and water bodies
  - Protect matrices of potential vernal pool habitat
  - Preserve multi-objective corridors and large intact areas
  - Discourage traditional "hard" solutions to flow control
  - WPA revisions: Stream crossing standards, meander belt protection, vernal pool buffer zones, flexible delineation criteria for Bordering Vegetative Wetlands
  - Support efforts to reduce nutrient loading into waterways and water bodies

- **Intact Landscapes**
  - Represent key geophysical and environmental gradients
  - Anchor conservation in sites of sufficient size and quality to be resilient over centuries
  - Maintain ecoregional scale processes and prevent isolation of targets
  - Distribute risks across geographically dispersed replicates
  - Design and implement strategies that decrease broad-based stresses. Monitor
  - Rely on Climate Adapted State Wildlife Action Plan

Common Themes

Natural Resources and Habitat

- **Vulnerabilities**
  - Disruptions in ecosystem functions (processes, structure, composition)
- **Strategies**
  - Ecological Resistance and Resilience
  - Strategic land protection, based on:
    - Representation, replication
    - Size, connectivity, buffers
  - Maintain and restore ecological function and structure
    - Hydrology, flow
    - Connectivity
    - Biodiversity richness
    - Nature-based adaptation (not “hard” solutions) w/ flexibility
  - Reduce other stressors (e.g. invasive spp., fragmentation, overharvesting)
  - CC/response modeling, mapping, monitoring, adaptive management
- **Overlap with other subcommittees**
  - Many Natural Resource strategies improve resilience of other sectors
  - Data gaps (e.g. LiDAR/SLR & storm surge projections)

Questions?

Natural Resources and Habitat

Thank You

CLIMATE CHANGE ADAPTATION ADVISORY COMMITTEE

- **Next Steps**
  - **Draft Report Chapters**
  - **Submit to Advisory Committee for review/comment**
  - **Submit Report to Agencies for review/comment**
- **Next Meeting**
  - **September 9, 2009**